

Appendix A

Fill-in Tables/Forms

This Appendix contains a set of forms copied from the different chapters in this manual. The form number corresponds to the respective forms in chapters 4 through 9; the first number digit represents the chapter number. Where the forms refer to a figure, it is understood that they refer to the figures shown in the main body of the manual.

It is anticipated that these tables will be photocopied and used (as many times as needed) to perform the Fire Safety Analysis of one or more LP-Gas facilities. The details of how to use the tables and what the results mean are indicated in the respective chapters; the user should refer to the information in the various chapters before using these tables.

The filled in tables may then be included in the written Fire Safety Analysis that has to be maintained by the LP-Gas facility owner/operator. If a need exists, the same report may be submitted to the Authority Having Jurisdiction (AHJ).

Form 4.1

Initial Data on the LP-Gas Facility

A	B	C
Item #	Information Item	Data
1	Name of the LP-Gas Plant Owner or Operator	
2	Contact Name:	
3	Contact Telephone & Fax Numbers	
4	Contact Email Address	
5	Mailing Address	Street 1:
		Street 2:
		City, State, Zip:

Form 4.2

Facility Storage Capacity^{1,2,3}

A	B	C	D
#	Individual Container Water Capacity (wc) (gallons)	Number of containers	Total Water Capacity (wc) of each container size (gallons)
1	500		
	1,000		
	2,000		
	4,000		
	10,000		
	18,000		
	30,000		
	60,000		
	Other:		
	Other:		
	Other:		
	Other:		
2	Aggregate Water Capacity ⁴		

- Notes:**
- (1) Column D = Column B x Column C.
 - (2) Parked bobtails, transports and tank cars should not be considered for aggregate capacity calculations.
 - (3) Do not consider containers that are not connected for use.
 - (4) For the purpose of this manual, "Aggregate Water Capacity" means a group of single ASME storage tanks connected together with manifold piping.

Form 4.3

Additional Information on the LP-Gas Facility

☐ Existing Facility; Built to NFPA 58 Edition _____ ☐ Proposed Facility

a) Name of the Facility (if applicable) _____

b) Type of LP-Gas Facility ☐ Commercial ☐ Industrial ☐ Bulk Plant

c) Facility is located in ☐ Rural Area, ☐ Suburban Area, ☐ City Commercial Zone
☐ City Industrial Zone

d) Facility neighbors[§]: ☐ Agri. fields ☐ Commercial Bldgs. ☐ Flammable Liquids Storage
 (Check all that apply) ☐ Industrial Activity (metal fabrication, cutting and welding, etc)
☐ Manufacturing ☐ Others (explain) _____

e) Geographic Location of Facility/Address: _____

f) Landmarks, if any: _____

g) LP-Gas liquid supply by: ☐ Bobtail ☐ Truck Transport ☐ Rail Tank Car
 (Check all that apply) ☐ Pipeline

h) LP-Gas Distribution by: ☐ Bobtail ☐ Truck Transport ☐ Vapor Piping
 (Check all that apply) ☐ Liquid Piping ☐ Dispensing or Vehicle Liquid fueling

i) Number of Vehicle Entrances: ☐ One ☐ Two ☐ More than two

j) Type of Access Roads to the Facility ☐ Rural ☐ City or Town ☐ Highway
 (One check per line) Entrance 1 ☐ Dirt road ☐ Gravel road ☐ Paved
 (One check per line) Entrance 2 ☐ Dirt road ☐ Gravel road ☐ Paved

k) Staff presence ☐ Not staffed ☐ Only during transfer operations
☐ Staffed always (24/7) ☐ Only during business hours
☐ Other (Explain) _____

l) Location and distances to Institutional Occupancies surrounding the facility, if any, within 250 ft from the facility boundary in the direction of the assets.

m) Overview plot plan of the facility attached? ☐ Yes ☐ No

[§] All properties either abutting the LP-Gas facility or within 250 feet of the container or transfer point nearest to facility boundary.

Form 5.1

Compliance with Code Requirements for Appurtenances on Containers of 2,000 Gallons Water Capacity or Less

A	B	C	D	E
Container #	Service Configuration Sub Figure (in Figure 5.1)	Number of Product Release Control Appurtenances		NFPA 58 Section Reference (2001 edition)
		Required by NFPA 58 (applicable edition)	Installed on the Container	
1				2.3.3.2(a) and Table 2.3.3.2(a)
2				
3				
4				
5				
6				

If, in Form 5.1, any one of the numbers in column D is less than the number in Column C of the corresponding row, these items must be addressed and brought into compliance with the specific edition of NFPA 58 that the facility was constructed to.

Form 5.2

Compliance with Code Requirements for Appurtenances on Containers Greater Than 2,000 through 4,000 Gallons Water Capacity Used in Residential and Commercial Facilities

A	B	C	D	E
Container #	Service Configuration Sub Figure (in Figure 5.1)	Number of Product Release Control Appurtenances		NFPA 58 Section Reference (2001 edition)
		Required by NFPA 58 (applicable edition)	Installed on the Container	
1				2.3.3.2(a) and Table 2.3.3.2 (a)
2				
3				
4				
5				
6				

If, in Form 5.2, any one of the numbers in column D is less than the number in Column C of the corresponding row, these items must be addressed and brought into compliance with the specific edition of NFPA 58 that the facility was constructed to.

Form 5.3

Compliance with Code Requirements for Appurtenances on Containers Having a Water Capacity of 2,001 through 4,000 Gallons Used in Bulk and Industrial Facilities

A	B	C	D	E	F	G
Container #	LP-Gas inlet to and outlet from the container**		Figure #	Total Number of Product Release Control Appurtenances		NFPA 58 Section Reference (2001 edition)
				Required by NFPA 58 (applicable edition)	Installed on the container	
1	Vapor	Inlet	5-2			3.3.3.6 (a)
		Outlet	5-3			3.3.3.6 (c)
	Liquid	Inlet	5-4			3.3.3.6 (b)(1)
		Outlet	5-5			3.3.3.6 (d)(1)
2	Vapor	Inlet	5-2			
		Outlet	5-3			
	Liquid	Inlet	5-4			
		Outlet	5-5			
3	Vapor	Inlet	5-2			
		Outlet	5-3			
	Liquid	Inlet	5-4			
		Outlet	5-5			
4	Vapor	Inlet	5-2			
		Outlet	5-3			
	Liquid	Inlet	5-4			
		Outlet	5-5			

** If the container does not provide an opening for the specific function listed, enter 0 (zero) in columns E and F corresponding to that row.

If, in Form 5.3, any one of the numbers in column F is less than the number in Column E of the corresponding row, these items must be addressed and brought into compliance with the specific edition of NFPA 58 that the facility was constructed to.

Form 5.4

Compliance with Code Requirements for Appurtenances on Containers Having a Water Capacity Greater Than 4,000 Gallons Used in Bulk and Industrial Facilities

A	B	C	D	E	F	G
Container #	LP-Gas inlet to and outlet from the container**		Figure #	Total Number of Product Release Control Appurtenances		NFPA 58 Section Reference (2001 edition)
				Required by NFPA 58 (applicable edition)	Installed on the container	
1	Vapor	Inlet	5.2			3.3.3.6 (a)
		Outlet	5.3			3.3.3.6 (c)
	Liquid	Inlet	5.6			3.3.3.6 (b)(2)
		Outlet	5.7			3.3.3.6 (d)(2)
2	Vapor	Inlet	5.2			
		Outlet	5.3			
	Liquid	Inlet	5.6			
		Outlet	5.7			
3	Vapor	Inlet	5.2			
		Outlet	5.3			
	Liquid	Inlet	5.6			
		Outlet	5.7			
4	Vapor	Inlet	5.2			
		Outlet	5.3			
	Liquid	Inlet	5.6			
		Outlet	5.7			

** If the container does not provide an opening for the specific function listed, enter 0 (zero) in columns E and F corresponding to that row.

If in Form 5.4 any one of the numbers in column F is less than the number in Column E of the corresponding row, these items must be addressed and brought into compliance with the specific edition of NFPA 58 that the facility was constructed to.

Form 5.5
Requirements for Transfer Lines of 1½-inch Diameter or Larger,
Liquid-into-Containers

A	B	C	D	E	F
Item #	Appurtenance (Either No. 1 or No. 2)**	Appurtenance Provided with the Feature	Installed in the facility?		NFPA 58 Section Reference (2001 edition)
			Yes	No	
1	Emergency Shutoff Valve (ESV)	Installed within 20 ft. of lineal pipe from the nearest end of the hose or swivel-type connections.			3.2.19.2
		Automatic shutoff through thermal (fire) actuation with melting point of thermal element < 250 °F			3.2.19.4
		Temperature sensitive element (fusible link) installed within 5 ft from the nearest end of the hose or swivel type piping connected to liquid transfer line,			3.2.19.4
		Manual shutoff feature provided at ESV installed location.			3.2.19.8
		Manual shutoff device provided at a remote location, not less than 25 ft., and not more than 100 ft. from the ESV.			3.2.19.8
		An ESV is installed on each leg of a multi leg piping each of which is connected to a hose or a swivel type connection on one side and to a header of size 1½ inch in diameter or larger on the other side.			3.2.19.3 4.2.3.6(a)
		Breakaway stanchion is provided such that in any pull-away break will occur on the hose or swivel-type connection side while retaining intact the valves and piping on the plant side.			3.2.19.6
			Yes	No	
2	Back flow Check Valve (BCK)**	Installed downstream of the hose or swivel-type connection			3.2.19.6
		BCK is designed for this specific application.			3.2.19.2 <i>Exception</i>
		A BCK is installed on each leg of a multi leg piping each of which is connected to a hose or a swivel type connection on one side and to a header of 1½ inch in diameter or larger on the other side.			3.2.19.3
		Breakaway stanchion is provided such that in any pull-away break will occur on the hose or swivel-type connection side while retaining intact the valves and piping on the plant side.			3.2.19.6

** The backflow check valve (BCK) is only permitted when flow is only into the container and shall have a metal-to-metal seat or a primary resilient seat with metal backup, not hinged with a combustible material.

Form 5.6
Requirements for Transfer Lines of 1½-inch Diameter or Larger,
Liquid Withdrawal From Containers

A	B	C	D	E	F
Item #	Appurtenance	Appurtenance Provided with the Feature	Installed in the facility?		NFPA 58 Section Reference
			Yes	No	
1	Emergency Shutoff Valve (ESV)	Installed within 20 ft. of lineal pipe from the nearest end of the hose or swivel-type connections.			3.2.19.2
		Automatic shutoff through thermal (fire) actuation with melting point of thermal element < 250 °F			3.2.19.4
		Temperature sensitive element installed within 5 ft from the nearest end of the hose or swivel type piping connected to liquid transfer line,			3.2.19.4
		Manual shutoff feature provided at E SV installed location.			3.2.19.8
		Manual shutoff device provided at a remote location, not less than 25 ft., and not more than 100 ft. from the ESV.			3.2.19.8
		An ESV is installed on each leg of a multi leg piping each of which is connected to a hose or a swivel type connection on one side and to a header of 1½ inch in diameter or larger on the other side.			3.2.19.3 4.2.3.6(a)
		Breakaway stanchion is provided such that in any pull-away break will occur on the hose or swivel-type connection side while retaining intact the valves and piping on the plant side.			3.2.19.6
		Number of ESV's in liquid withdrawal service			

Note: If more than one ESV is installed in the facility, use one Form 5.6 for each ESV.

Form 5.7
Requirements for Vapor Transfer Lines 1¼-inch Diameter or Larger

A	B	C	D	E	F
Item #	Appurtenance	Appurtenance Provided with the Feature	Installed in the facility?		NFPA 58 Section Reference (2001 edition)
			Yes	No	
1	Emergency Shutoff Valve (ESV)	Installed within 20 ft. of lineal pipe form the nearest end of the hose or swivel-type connections.			3.2.19.2
		Automatic shutoff through thermal (fire) actuation with melting point of thermal element < 250 °F			3.2.19.4
		Temperature sensitive element installed within 5 ft from the nearest end of the hose or swivel type piping connected to liquid transfer line,			3.2.19.4
		Manual shutoff feature provided at E SV installed location.			3.2.19.8
		Manual shutoff device provided at a remote location, not less than 25 ft., and not more than 100 ft. from the ESV.			3.2.19.8
		An ESV is installed on each leg of a multi leg piping each of which is connected to a hose or a swivel type connection on one side and to a header of 1½ inch in diameter or larger on the other side.			3.2.19.3 4.2.3.6(a)
		Breakaway stanchion is provided such that in any pull-away break will occur on the hose or swivel-type connection side while retaining intact the valves and piping on the plant side.			3.2.19.6

If a checkmark is made in the “NO” column of any one of Form 5.5, Form 5.6 or Form 5.7, then these items must be addressed and brought into compliance with the specific edition of NFPA 58 that the facility was constructed to.

Form 5.8

Evaluation of Redundant and Fail-Safe Design

A	B		C	D	E	F
Item #	Description		Features	Installed in the facility?		NFPA 58 Section Reference (2001 edition)
				Yes	No	
1	Container Sizes for which the appurtenances are provided		Redundant Fail-Safe equipment and Low Emission transfer lines are provided for <u>each</u> container of water capacity greater than 2,000 gal through 30,000 gal			3.11
2	LIQUID OR VAPOR WITHDRAWAL (1-1/4 in. or larger)		Internal Valve with integral excess flow valve or excess flow protection			3.11.3.1
			Positive Shutoff Valve installed as close as possible to the Internal Valve			3.11.3.2
3	LIQUID OR VAPOR INLET		Internal Valve with integral excess flow valve or excess flow protection or Back Flow Check valve			3.11.3.3
			Positive Shutoff Valve installed as close as possible to the Internal Valve or the back flow check valve			3.11.3.2
4	Railcar Transfer	Flow Into or Out of Railroad tank car	Internal Valve installed in the transfer hose or the swivel-type piping at the tank car end			4.2.3.6(a)
		Flow Only into railroad tank car	Internal valve or backflow check valve installed in the transfer hose or the swivel-type piping at the tank car end			4.2.3.6(b)
5	Cargo Tank Transfer		Protection provided in accordance with 3.2.19			3.2.19
6	Automatic closure of all primary valves (IV & ESV) in an Emergency		Actuated by Fire Detection			3.11.3.1
			Actuated by a hose pull-away due to vehicle motion			3.11.4.2
7	Manually operated remote shutdown of IV and ESV		Remote shutdown station within 15 ft of the point of transfer?			3.11.4.3(a)
			Another remote shutdown station between 25 ft and 100 ft of the transfer point?			3.11.4.3(b)
			Shutdown stations will shut down electrical power supply, if any, to the transfer equipment and primary valves?			3.11.4.3
			Signs complying with the requirements of 3.11.4.3 (c) provided?			3.11.4.3(c)

Note: If the facility does not have a rail terminal, write the word NA in both the “Yes” column and the “No” column in item 4 of this Form in the railroad tank car row. Similar option is also available if there is no cargo tank vehicle transfer station.

Form 5.9

Evaluation of Low Emission Transfer Equipment

A	B	C		D	E	F
Item #	Description	Features		Installed in the facility?		NFPA 58 Section Reference
				Yes	No	
1	Transfer into Cylinders or ASME Containers on Vehicles	Delivery Nozzle and Filler Valve- Max. Liquid Release after transfer of 4 cc.	Fixed Maximum Liquid Level Gage not used during transfer operations			3.11.5.1
2	Transfer into Stationary ASME Containers. Delivery valve and nozzle combination	Minimize the liquid product volume released to the atmosphere during product transfer or post transfer uncoupling of the hose	does not exceed 4 cc (0.24 in ³) from a hose of nominal size 1 in or smaller			3.11.5.1(a)
			does not exceed 15 cc (0.91 in ³) from a hose of nominal size larger than 1 in.			3.11.5.1(b)
3	Transfer into Stationary ASME Containers Maximum filling limit	Do containers of less than 2,001 gal (w.c.) have an overfilling prevention device or an other approved device?				3.11.5.2(c)
		Do containers of greater than 2,000 gal (w.c.) have a float gage or other non-venting device?				3.11.5.2(b)
4	Transfer into Stationary ASME Containers Fixed Maximum Liquid Level gage	Not used during routine transfer operations but used to calibrate other non-venting liquid level gages in the container				3.11.5.1(b)

Note: 1) If the facility does not have a particular feature described in the table, write “NA” in both the “Yes” and “No” columns corresponding its row in item 2.

Form 6.1

Evaluation of Physical Protection and Other Measures

A	B	C	D	E	F
#	Item	Features	Installed in the facility?		NFPA 58 Section Reference
			Yes	No	
1	Lighting [‡]	Provide lighting For nighttime operations to illuminate storage containers, container being loaded, control valves, and other equipment			3.3.7
2	Vehicle impact protection	Protection against vehicular (traffic) impacts on containers, transfer piping and other appurtenances is designed and provided commensurate with the size of vehicles and type of traffic in the facility. (Example protection systems include but not limited to (1) Guard rails, (2) Steel bollards or crash posts, (3) Raised sidewalks.			2.3.7.2 3.2.15.7
3	Protection against corrosion	Provide protection against corrosion where piping is in contact with supports or corrosion causing substances.			3.2.15.7
Complete only 4A or 4B					
4A	Perimeter Fence	Is an industrial type or chain link fence of at least 6 ft high or equivalent protection provided to enclose (all around) container appurtenances, pumping equipment, loading and unloading and container filling facilities?			3.3.6.1
		Are at least two means of emergency accesses (gates) from the enclosure provided? NOTE: Write "N.A." (not applicable) if (i) The area enclosed is less than 100 ft ² , or (ii) The point of transfer is within 3 ft of the gate, or containers are not filled within the enclosure			3.3.6.1 and associated Exception 1
		Is a clearance of, at least, 3 feet all around to allow emergency access to the required means of egress been provided?			3.3.6.1
	Guard Service	If a guard service is provided, does this service cover the LP-Gas plant and are the guard personnel provided with appropriate LP-Gas related training, per section 1.5 of NFPA 58?			3.3.6.1
4B	Lock-in-Place devices	Are Lock-in-Place devices provided to prevent unauthorized use or operation of any container appurtenance, system valves, equipment in lieu of the fence requirements above?			3.3.6.1 or 3.3.6.2

Fill only items 1, 2, 3, and 4A or 4B. Leave blank or indicate by "NA" when not filling the "YES" or "NO" column.

[‡] Leave blank if the facility is not operated at night.

Form 6.2

Ignition Source Control Assessment

A	B	C	D	E
#	Ignition Control Requirement	Is the Facility compliant?		NFPA 58 Section Reference
		Yes	No	
1	Are combustible materials, weeds and tall grass not closer than 10 ft from each container?			3.2.2.6
2	Is distance at least 20 ft between containers and tanks containing flammable liquids with flash point less than 200 °F (ex., gasoline, diesel)			3.2.2.6
3	Are electrical equipment and wiring are installed per Code requirements?			3.7.2
4	Are open flame equipment located and used according to Code?			3.7.3
5	Are ignition control procedures and requirements during liquid transfer operations complied with.?			4.2.3.2
6	Is an approved, portable, dry chemical fire extinguisher of minimum capacity 18 Lbs and having a B:C rating provided in the facility?			3.10.2.4
7	Is an approved, portable, dry chemical fire extinguisher of minimum capacity 18 Lbs and having a B:C rating provided on each truck or trailer used to transport portable containers?			6.2.4
8	Is the prohibition on smoking within the facility premises strictly enforced?			4.2.3.2 & 6.3.10

- Notes:**
- 1) If there is no flammable or Class II combustible liquid storage in or nearby the facility insert "NA" in both "Yes" and "No" columns of row 2.
 - 2) If there are no electrical equipment or there are no open flame equipment in the facility, then facility insert "NA" in both "Yes" and "No" columns corresponding to the appropriate rows.

Form 6.3

Separation Distances from containers to buildings, property line that can be built upon, inter-container distances, and aboveground flammable or combustible storage tanks

A	B	C	D	E	F	G
#	Container Size Range in gal (W.C.)	Separation Between A property line, important building or other property and the <u>nearest</u> container which is	Minimum Distance (ft)	Is the Facility compliant?		NFPA 58 Section Reference
				Yes	No	
1	501 through 2,000	Above Ground	25			Table 3.2.2.2
		Underground or Mounded	10			
		Between containers	3			
2	2,001 through 30,000	Above Ground	50			
		Underground or Mounded	50			
		Between containers	5			
3	30,001 through 70,000	Above Ground	75			
		Underground or Mounded	50			
		Between containers	$\frac{1}{4}$ sum of diameters of adjacent containers			
4	70,001 through 90,000	Above Ground	100			
		Underground or Mounded	50			
		Between containers	$\frac{1}{4}$ sum of diameters of adjacent containers			
5	All sizes greater than 125 gal	Separation distance between a LP-Gas container and an above ground storage tank containing flammable or combustible liquids of flash points below 200 °F.	20			3.2.2.6 (e)

Note: If any of the container sizes indicated in the above form are not present in the facility, enter "NA" in both Yes and No columns. Do not count them for compliance with the code.

Form 6.4

Separation Distances between Points of Transfer and other Exposures

A	B		C	D	E	F	G
#	Type of Exposure within or outside the facility boundary		Check if exposure is present	Minimum Distance (ft)	Is the Facility compliant?		NFPA 58 Section Reference
					Yes	No	
1	Buildings, mobile homes, recreational vehicles, and modular homes with fire-resistive walls			10			Table 3.2.3.3
2	Buildings with other than fire resistive walls			25			
3	Building wall openings or pits at or below the level of the point of transfer			25			
4	Line of adjoining property that can be built upon			25			
5	Outdoor places of public assembly, including school yards, athletic fields, and playgrounds			50			
6	Public ways, including public streets, highways, thoroughfares, and sidewalks	From points of transfer in LP-Gas dispensing stations and at vehicle fuel dispensers.		10			
		From other points of transfer		25			
7	Driveways			5			
8	Mainline railroad track centerlines			25			
9	Containers other than those being filled			10			
10	Flammable and Class II combustible liquid dispensers and aboveground and underground containers			20			
11	Flammable and Class II combustible liquid dispensers and the fill connections of LPG containers			10			
12	LP-Gas dispensing device located close to a Class I liquid dispensing device.			10			3.9.4.3

NOTE: Place a checkmark in column C against an exposure that is present in or around the facility. Fill columns E or F for only those rows for which there is a checkmark in column C.

Form 6.5

Special Protection Measures – Requirements for Passive Systems

A	B	C	D		E
#	Special Protection Option	Question	Is the Facility compliant?		NFPA 58 Section Reference (2001)
			Yes	No	
1	Container Insulation	Insulation provided on each of the containers?			3.10.3.1
		Insulation material complies with the requirements of section 3.10.3.1 of NFPA 58?			3.10.3.1
2	Mounding of containers	Each container in the facility is mounded?			3.10.3.2
		Mounding complies with each requirement under section 3.2.9.3 of NFPA 58.			3.10.3.2
3	Burying of containers	Each container in the facility is buried?			3.10.3.3
		Buried containers comply with each requirement under section 3.2.9.1 of NFPA 58.			3.10.3.3 and 3.2.9.1

Form 6.6

Special Protection Measures – Requirements for Active Systems

#	Special Protection Option	Question	Is the Facility compliant?		NFPA 58 Section Reference (2001)
			Yes	No	
1	Water spray systems	Are fixed water spray systems, complying with NFPA 15 ¹ requirements, used for each container in the facility?			3.10.3.4
		Do fire responsive devices actuate water spray system automatically?			3.10.3.4
		Can the water spray systems be actuated manually also?			3.10.3.4
2	Monitor nozzle systems	Are the monitor nozzles located and arranged so that the water stream can wet the surfaces of all containers exposed to a fire?			3.10.3.5
		Can the water stream from a monitor nozzle reach and wet the entire surface of, at least, one half of a length from one end of each of the containers it is designed to protect?			3.10.3.5
		Do fixed monitor nozzles comply with NFPA 15 ¹ requirements?			3.10.3.5
		Do fire responsive devices actuate the monitor nozzles?			3.10.3.5
		Can the monitor nozzles can be actuated manually also?			3.10.3.5

1. Refer to Chapter 8 for a discussion on NFPA 15 *Standard for Water Spray Fixed Systems for Fire Protection*

Form 7.1

Types of Occupancies⁽¹⁾ Near or Surrounding the LP-Gas Facility

Type of Occupancies	Model from Table 7.1 (2)	Is an Occupancy located within the hazard distance from the Facility?	
		Yes	No
Assembly Occupancies (Places of worship, Libraries, Theaters and Auditoriums, Food or Drink Bars, Sports Stadiums, Amusement Parks, Transportation Centers, etc. with 50 or more people).			
Institutional Occupancies (Elderly Persons Home or Nursing Home, Hospitals, Alcohol & Drug Rehabilitation Centers, Prisons)			
Educational Occupancies (Elementary Schools, Day Care facilities, etc).			

NOTES: (1) See Glossary for the definitions of occupancies (Ref: NFPA 5000)

- (2) Table 7.1 provides a number of scenarios that can result in propane release, and the resulting area exposed for different ignition mechanisms. Determine the scenarios that are applicable to the facility, for the quantities that can be released. Use the hose diameters and length that will be used at the facility if they differ from the ones in Table 7.1 and recalculate the hazard distances using a spreadsheet method that is available at npga.org. Some scenarios may not be applicable to an installation based on other mitigation measures taken, such as a hose management procedure to minimize the possibility of hose failure.

Form 7.2

Exposure to LP-Gas Facility from External Hazards

A	B	C	D
Item #	Type of Neighboring Operation	Hazard exists to the LP-Gas Facility	
		YES	NO
1	Petroleum and other hazardous material storage, wholesale dispensing, etc.		
2	Metal cutting, welding, and metal fabrication		
3	Industrial Manufacturing that can pose external hazards		
4	Ports, rail yards and trans-shipment terminals handling flammable and explosive materials.		
5	Other operations that may pose hazards (Gasoline and other hazardous material dispensing stations, fertilizer storage, etc).		

NOTE: If a particular activity indicated in column B does not exist, fill both "YES" and "NO" columns with "N/A."

Where a "YES" has been checked in either Form 7.1 or Form 7.2:

- 1) For an existing facility, communicate this information to local emergency responders for inclusion in their emergency planning.
- 2) For a proposed facility, implement the actions indicated in Chapter 9.

Form 8.1

Data on the Responding Fire Department

A	B	C
Item #	Data Item	Data Entry
1	Name of the Fire Department (FD).	
2A	Name of the person in the FD assisting with the data acquisition.	
2B	Position of the person in the FD assisting with the data acquisition.	
3A	Date on which FD data was collected.	
3B	Name of the person collecting the data.	
4	Number of firefighters on duty at any time.	
5	Average number of firefighters available for response.	
6A	Number of firefighters qualified to	"Firefighter I" level.
6B		"Firefighter II" level.
7A	Number of firefighters who would	respond on the first alarm to the facility.
7B		respond on the first alarm and who are qualified to the operations level requirements of NFPA 472 or local requirements
7C		respond on the first alarm with specific knowledge and training on the properties of LP-Gas and LP-Gas fires.
8A	Number of fire apparatus that have the capability to deploy a 125 gpm hose line supplied by onboard water for at least 4 minutes, and	that are in service in the department.
8B		that would respond on a first alarm.

Form 8.2
Response Time data for the Fire Departments

A	B	C	D	E
Company or Department	Time in Minutes for			
	Alarm Receipt & Handling	Turnout	Travel	Total Time

Note: Number in Column E = Sum of numbers from Columns B through D.

Form 8.3

Water Flow Rate and Total Water Volume Required to Cool Containers Exposed to a Fire

A	B	C	D	E	F	G	H
Item #	ASME Container Size (gallons)	Total Surface Area of each Container ⁱ (ft ²)	Surface Area of each container to be Cooled (ft ²)	Water flow rate required per container (gpm)	Number of containers of the size indicated	Total Water flow rate required (gpm)	Total volume of water required for 10 min (gal)
1	500	86	43	10.8			
	1,000	172	86	21.5			
	2,000	290	145	36.3			
	4,000	374	187	46.8			
	6,500	570	285	71.3			
	9,200	790	395	98.8			
	12,000	990	495	123.8			
	18,000	1,160	580	145.0			
	30,000	1,610	805	201.3			
	45,000	2,366	1,183	295.8			
	60,000	3,090	1,545	386.3			
	90,000	4,600	2,300	575.0			
	Other Size						
2a	Calculated water flow rate for container protection						
2b	Water flow rate rounded up to nearest multiple of 125						
3	Water for firefighter protection, if required					250	
4	Total water rate and volume						

Note: Column D = (1/2) x Column C

Column E = 0.25 (gpm/ft²) x Column D ;

Column G = Column F x Column E

Column H = 10 x Column G

Line 2, Column G and Column H are the sum of numbers in each row above line 2 of each column.

Line 4, Column G and Column H are the sum of numbers in rows 2 and 3.

Consider only 3 containers for water supply evaluations even if the number of containers in a group is more than 3.

ⁱ ASME container dimensions obtained from www.standby.com/products/storage_tanks.html

Form 8.4

Evaluation of Water Availability in or Near the LP-Gas Facility

A	B	C	D		
Item #	Water from	Available?	Quantitative information		
1	Public supply or from another piped-in supply through one or more fire hydrants in or near the facility	<input type="checkbox"/> Yes <input type="checkbox"/> No	Hydrant data	Distance from Facility gate (feet)	Available water flow rate from all hydrants ⁽¹⁾ (gpm)
			Hydrant 1		
			Hydrant 2		
			Hydrant 3		
2	A nearby static water source (stream, pond, lake, etc).	<input type="checkbox"/> Yes <input type="checkbox"/> No	Distance to water source = _____ Feet Time to set up relay = _____ min. Rate of delivery = _____ gpm		
3	Only through mobile water tanker shuttle.	<input type="checkbox"/> Yes <input type="checkbox"/> No	Time to set up shuttle = _____ min. Sustainable flow rate = _____ gpm		

NOTE: (1) Obtain the flow rate in each hydrant from the local municipal water authority or the entity that supplies water to the hydrant or conduct a test to determine total available flow rate.

Form 9.1

Analysis Summary on Product Control and Local Conditions of Hazard

A	B	C	D	E
Item #	CHAPTER Title	Section & Title	Reference FORM #	Number of "NO" checked [§]
1	Product Control Measures in Containers & Transfer Piping	5.1: Product Control in Containers	5.1 or 5.2 or 5.3 or 5.4	
		5.2 Product Control in Transfer Piping	5.5	
			5.6	
			5.7	
			5.8	
			5.9	
2	Analysis of Local Conditions of Hazard	6.1 Physical Protection Measures	6.1	
		6.2 Ignition Source Control	6.2	
		6.3.1 Separation distances; Container and outside exposures	6.3	
		6.3.2 Separation distances; Transfer points and outside exposures	6.4	
		6.4 Special Protection Measures	6.5	
			6.6	

§ The number of "NO" for Forms from Chapter 5 are the difference between NFPA 58-2001 required number of appurtenances and a lesser number actually installed on the container or the transfer piping.

If in any row of column E ("NO") of Form 9.1, the entry number is greater than zero, the proposed LP-Gas facility is not in compliance with the 2001 NFPA 58 Code requirements for product control appurtenances or other safety measures. The design of the proposed facility must be modified to conform to the Code requirements. In addition, the following items should be noted.

- If there are any "NO" checks in Form 6.3, then the separation distance requirements for containers are not satisfied. An option that may be considered is the reduction in separation distance to 10 feet for underground and mounded containers by providing "Redundant and Fail-Safe Product Control Measures." In this case, complete Form 9.4, below to ensure that each requirement of "Redundant and Fail-Safe Product Control Measures" is provided.
- If there are any "NO" checks in Form 6.4, then the separation distance requirements for transfer points are not satisfied. In this case, relocate the transfer points so that the separation distances conform to the code requirements or provide the Low Emission Transfer Equipment. Complete Form 9.5 below and ensure that all requirements for Low Emission Transfer Equipment are fulfilled.

Form 9.2

Analysis Summary on Exposure from and to the LP-Gas Facility

A	B	C	D	E
Item #	CHAPTER Title	Section & Title	Reference FORM #	Number of "YES" checked
1	Exposure to and from Other Properties	7.1 Exposure to off-site properties and persons from in-plant propane releases	7.1	
		7.2 Exposure to propane facility from external events.	7.2	

If the entry number in column E ("YES"), Form 9.2 corresponding to Form 7.1 is greater than zero, consider one or more of the following design alternatives.

- 1 Consider moving the container or the transfer point to a different location, if possible and space exists, so that the property or the person is beyond the hazard distance.
- 2 Provide "Redundant and Fail-safe Product Control Measures". Complete Form 9.4 to ensure compliance.
- 3 Institute other technical measures such as installing gas and flame detectors (connected to facility shut down systems), sounding alarm outside facility premises, etc.
- 4 Institute administrative controls such as additional training for personnel, more frequent inspection of hoses and transfer piping, etc.

If the entry number in column E ("YES"), Form 9.2 corresponding to Form 7.2 is greater than zero, consider one or more of the following design alternatives.

- 1 Implement procedures to monitor neighboring activity.
- 2 Install means in the adjacent plant to shut down the LP-Gas plant in case emergency in that plant.

Form 9.3

Analysis Summary on Fire Department Evaluations

A	B	C	D	E	F
Item #	CHAPTER Title	Section & Title	Reference FORM #	Number "zeros" entered in Lines 6 through 8	Number of "Yes" checked in Column C
1	Fire department capability, adequacy of water supply and Emergency Planning	8.1 Data on the Fire Department	8.1		
2		8.2 Fire response water needs and availability	8.4		

If the entry number in Cell 1, Column E of Form 9.3 is greater than zero, consider one or more of the following design alternatives.

- 1 Discuss with the local Fire Department the needs of the LP-Gas facility and the evaluation results on the capability and training inadequacies of the Department.
- 2 Consider developing a cadre of personnel within the LP-Gas facility to respond to emergencies.
- 3 Institute container special protection system based on active protection approaches or passive approaches. Complete Form 9.6 and Form 9.7 below.

If the entry number in Cell 2, Column F of Form 9.3 is equal to zero, consider one or more of the following design alternatives.

- 1 Provide special protection (other than water spray or monitor systems) to containers, satisfying the requirements of section 3.10.3 of NFPA Code. Complete Form 9.6 to ensure compliance.
- 2 Consider implementing the various options indicated in Table 9.1.

Form 9.4

Redundant and Fail-Safe Design for Containers

A	B		C	D	E	F
Item #	Description		Features	Proposed for the facility?		NFPA 58 Section Reference
				Yes	No	
1	Container Sizes for which the appurtenances are provided		Redundant Fail-Safe equipment and Low Emission transfer lines are provided for <u>each</u> container of water capacity 2,001 gal to 30,000 gal			3.11
2	Liquid or Vapor Withdrawal (1-1/4 in. or larger)		Internal Valve with integral excess flow valve or excess flow protection			3.11.3.1
			Positive Shutoff Valve installed as close as possible to the Internal Valve			3.11.3.2
3	Liquid or Vapor Inlet		Internal Valve with integral excess flow valve or excess flow protection or Back Flow Check valve			3.11.3.3
			Positive Shutoff Valve installed as close as possible to the Internal Valve or the back flow check valve			3.11.3.2
4	Railcar Transfer	Flow Into or Out of Railroad tank car	Emergency Shutoff Valve installed in the transfer hose or the swivel-type piping at the tank car end.			4.2.3.6(a)
		Flow Only Into railroad tank car	Emergency shutoff valve or backflow check valve installed in the transfer hose or the swivel-type piping at the tank car end.			4.2.3.6(b)
5	Cargo Tank Transfer		Protection provided in accordance with 3.2.19			3.2.19
6	Automatic closure of all primary valves (IV & ESV) in an Emergency		By fire actuation			3.11.3.1
			In the event of a hose pull-away due to vehicle motion			3.11.4.2
7	Manually operated remote shutdown of IV and ESV		Remote shutdown station within 15 ft of the point of transfer?			3.11.4.3(a)
			Another remote shutdown station between 25 ft and 100 ft of the transfer point?			3.11.4.3(b)
			Shutdown stations will also turn off electrical power supply, if any, to the valves?			3.11.4.3
			Large letter signs complying with the requirements of 3.11.4.3 (c) provided?			3.11.4.3(c)

Note: If your facility does not have a rail terminal, write the word NA in both the “Yes” column and the “No” column in item 4 of the form in the railroad tank car row. Similar option is also available if there is no cargo tank vehicle transfer station.

Form 9.5

Low Emission Transfer Equipment

A	B	C		D	E	F
Item #	Description	Features		Proposed for the facility?		NFPA 58 Section Reference
				Yes	No	
1	Transfer into Cylinders or ASME Containers on Vehicles	Delivery Nozzle and Filler Valve-Max. Liquid Release after transfer of 4 cc.	Fixed Maximum Liquid Level Gauge not used during transfer operations			3.11.5.1
2	Transfer into Stationary ASME Containers Delivery valve and nozzle combination	During product transfer or post transfer uncoupling of the hose, liquid product volume released to the atmosphere	Does not exceed 4 cc (0.24 in ³) from a hose of nominal size 1 in or smaller			3.11.5.1(a)
			Does not exceed 15 cc (0.91 in ³) from a hose of nominal size larger than 1 in.			3.11.5.1(b)
3	Transfer into Stationary ASME Containers Maximum filling limit	For containers of size less than 2,001 gal (wc) overfilling prevention device or other approved device is provided.				3.11.5.2(c)
		For a container of capacity greater than 2,000 gal (wc) float gauge or other non-venting device is provided				3.11.5.2(b)
4	Transfer into Stationary ASME Containers Fixed Maximum Liquid Level gauge	Not used during routine transfer operations but may be used in calibrating other non-venting liquid level gauges in the container				3.11.5.1(b)

Note: If the facility does not have a particular feature described in the table, write "NA" in both the "Yes" and "No" columns corresponding its row in item 2.

Form 9.6
Special Protection Measures –Passive Systems

A	B	C	D		E
Item #	Special Protection Option	Question	Proposed for the facility?		NFPA 58 Section Reference
			Yes	No	
1	Insulation around the container	Insulation provided on each of the containers?			3.10.3.1
		Insulation material complies with the requirements of section 3.10.3.1 of NFPA 58?			3.10.3.1
2	Mounding of containers	Each container in the facility is mounded?			3.10.3.2
		Mounding complies with each requirement under section 3.2.9.3 of NFPA 58.			3.10.3.2
3	Burying of containers	Each container in the facility is buried?			3.10.3.3
		Buried containers comply with each requirement under section 3.2.9.1 of NFPA 58.			3.10.3.3 and 3.2.9.1

Form 9.7
Special Protection Measures –Active Systems

Item #	Special Protection Option	Question	Is the Facility compliant?		NFPA 58 Section Reference
			Yes	No	
1	Water spray systems	Are fixed water spray systems, complying with NFPA 15 requirements, used for each container in the facility?			3.10.3.4
		Do fire responsive devices actuate water spray system automatically?			3.10.3.4
		Can the water spray systems be actuated manually also?			3.10.3.4
2	Monitor nozzle systems	Are the monitor nozzles located and arranged so that the water stream can wet the surfaces of all containers exposed to a fire?			3.10.3.5
		Can the water stream from a monitor nozzle reach and wet the entire surface of, at least, one half of a length from one end of each of the containers it is designed to protect?			3.10.3.5
		Do fixed monitor nozzles comply with NFPA 15 requirements?			3.10.3.5
		Do fire responsive devices actuate the monitor nozzles?			3.10.3.5
		Can the monitor nozzles can be actuated manually also?			3.10.3.5

Equivalent Protection to a Water Supply for Bulk and Industrial Facilities

In the case where water supply is not available in or near the LP-Gas facility, or is inadequate or is prohibitively expensive to connect to a public or private water supply hydrant, alternative methods for providing protection should be considered. In lieu of providing a water supply, several alternatives are indicated in Table 9.1, which can offer an equivalency to a water supply system.

The intent of the controls identified in Table 9.1 is to maintain the entire system as a gas tight entity. These methods include reducing the service life of equipment, increasing the design pressure rating of the system beyond the requirements of NFPA 58, or providing early detection and isolation of the system to ensure product control. This list is not exhaustive and is not ranked in an order of priority.

Table 9.1
Equivalent Protection to a Water Supply for Industrial
and Bulk Facilities

Item #	Possible options to implement when adequate water supply is not available
1	Reduce the service life of hoses
2	Increase frequency of equipment inspection
3	Establish a service life program for the maintenance of the container's pressure relief devices. This could include the installation of a listed multiple port valve and certifying that the relief devices are properly set and maintained every 5 to 10 years.
4	Increase the strength of the piping and fitting systems
5	Install emergency shutoff valves in conjunction with container internal valves
6	Install emergency shutoff valves downstream of transfer pump outlets, and upstream of the vapor and liquid valves at the bulkhead.
7	Install pneumatic tubing along the plant boundary to serve as a perimeter fire detection system. This would provide protection of the plant against exposure fires.
8	Provide optical flame detection or linear heat detection, or a gas detection system connected to an isolation valve installed downstream of every liquid and vapor nozzle on the container. This system could also be monitored to send a signal to an alarm company that notifies the Fire Department of an event.
9	Increase the separation distances of internal plant exposures to the container. These exposures would include a site dumpster, idle or waste pallets and combustibles, and increasing the parking distances between the bobtails and transports in relation to the container.
10	Relocate overhead power lines away from all container and cylinder storage area to protect against ignition in the event of a line dropping due to wind or power pole impact
11	Eliminate all combustible vegetation within 30 feet of the LP-Gas container. This can be accomplished using gravel, or paving the site yard.

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- 1) For an existing facility, communicate this information to local responders for inclusion in their emergency planning.
 - 2) For a proposed facility, refer to Chapter 9.